Designation: E2231 – 15

An American National Standard

Standard Practice for Specimen Preparation and Mounting of Pipe and Duct Insulation Materials to Assess Surface Burning Characteristics[1]

This standard is issued under the fixed designation E2231; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

1. Scope

1.1 This practice describes procedures for specimen preparation and mounting when testing pipe and duct insulation materials to assess flame spread and smoke development as surface burning characteristics using Test Method E84.

1.2 If the pipe or duct insulation materials to be tested are reflective insulation materials (see 3.2.10 and 3.2.11), the materials shall be tested using the procedures for specimen preparation and mounting described in Practice E2599 and not the procedures described in 6.1 through 6.6.

1.3 Testing is conducted with Test Method E84.

1.4 This practice does not provide pass/fail criteria that can be used as a regulatory tool.

1.5 Use the values stated in inch-pound units as the standard, in referee decisions. The values in the SI system of units are given in parentheses, for information only; see IEEE/ASTM SI-10 for further details.

1.6 This fire standard cannot be used to provide quantitative measures.

1.7 Fire testing of products and materials is inherently hazardous, and adequate safeguards for personnel and property shall be employed in conducting these tests. Fire testing involves hazardous materials, operations, and equipment. This standard gives instructions on specimen preparation and mounting, but the fire-test-response method is given in Test Method E84. See also Section 8.

1.8 The text of this standard references notes and footnotes which provide explanatory material. These notes and footnotes (excluding those in tables and figures) shall not be considered requirements of the standard.

1.9 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

1.10 This fire standard cannot be used to provide quantitative measures.

2. Referenced Documents

2.1 *ASTM Standards:*[2]

A390 Specification for Zinc-Coated (Galvanized) Steel Poultry Fence Fabric (Hexagonal and Straight Line)

C168 Terminology Relating to Thermal Insulation

C1136 Specification for Flexible, Low Permeance Vapor Retarders for Thermal Insulation

C1224 Specification for Reflective Insulation for Building Applications

C1396/C1396M Specification for Gypsum Board

E84 Test Method for Surface Burning Characteristics of Building Materials

E176 Terminology of Fire Standards

E2599 Practice for Specimen Preparation and Mounting of Reflective Insulation, Radiant Barrier and Vinyl Stretch Ceiling Materials for Building Applications to Assess Surface Burning Characteristics

IEEE/ASTM SI-10 International System of Units (SI) The Modernized Metric System

2.2 *UL Standards:*

UL 181 Standard for Safety for Factory-Made Air Ducts and Connectors[3]

3. Terminology

3.1 *Definitions*—For definitions of terms used in this practice refer to the terminology contained in Terminology E176.

3.2 *Definitions of Terms Specific to This Standard:*

[1] This practice is under the jurisdiction of ASTM Committee E05 on Fire Standards and is the direct responsibility of Subcommittee E05.22 on Surface Burning.

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[2] For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

[3] Available from Underwriters Laboratories (UL), Corporate Progress, 333 Pfingsten Rd., Northbrook, IL 60062.

3.2.1 *composite, n—as related to a pipe or duct insulation*, see *duct insulation system* or *pipe insulation system*.

3.2.2 *duct, n—as related to heating ventilating, air conditioning or exhaust systems*, a passageway made of sheet metal or other suitable material used for conveying air or other gases.

3.2.3 *duct insulation system, n—as related to fire testing*, system intended to insulate and cover, continuously for an extended length, the outside surface of a duct; the system shall have an insulation core, with or without a covering or vapor retarder facing which includes longitudinal closure systems (if used) and perhaps other duct insulation supplementary materials such as adhesives, fasteners, or tapes (if used).

3.2.3.1 *Discussion*—Duct system components, including tapes, sealants, and fitting covers, that do not cover the duct continuously for an extended length, but which are associated with the duct insulation system are considered separately (see duct insulation supplementary materials). An extended length is not intended to imply a length of 25 ft, but a length of at least 3 ft.

3.2.4 *duct insulation supplementary materials, n—as related to fire testing*, components, including tapes and sealants used for transverse joints as well as fitting covers that are intermittently spaced, as needed, within the duct insulation system, as well as adhesives used to bond the insulation to the duct substrate and that do not cover the duct continuously for an extended length.

3.2.5 *duct lining, n*—material such as an insulation, coating or film, including adhesive, used to line the inside surface of a duct.

3.2.6 *insulation blanket, n*—a relatively flat and flexible insulation in coherent sheet form furnished in units of substantial area.[4]

3.2.7 *pipe, n—as related to heating, ventilating, or air conditioning systems*, a cylindrical conduit for the conveyance of liquids or semi-solids.

3.2.8 *pipe insulation system, n—as related to fire testing*, system intended to insulate and cover, continuously for an extended length, the outside surface of a pipe; the system shall have an insulation core, with or without a covering or vapor retarder facing which includes longitudinal closure systems (if used) and perhaps other pipe insulation supplementary materials such as adhesives, fasteners, or tapes (if used).

3.2.8.1 *Discussion*—Pipe system components, including tapes, sealants, and fitting covers, that do not cover the pipe continuously for an extended length, but which are associated with the pipe insulation system are considered separately (see pipe insulation supplementary materials). An extended length is not intended to imply a length of 25 ft, but a length of at least 3 ft.

3.2.9 *pipe insulation supplementary materials, n—as related to fire testing*, components, including tapes and sealants used for transverse joints as well as fitting covers that are intermittently spaced, as needed, within the pipe insulation system, as well as adhesives used to bond the insulation to the pipe substrate and that do not cover the pipe continuously for an extended length.

3.2.10 *reflective insulation, n*—thermal insulation consisting of one or more low emittance surfaces bounding one or more enclosed air spaces.

3.2.10.1 *Discussion*—Reflective insulation materials are defined in Specification C1224.

3.2.11 *reflective plastic core insulation, n*—an insulation material packaged in rolls, that is less than 0.5 in. (12.7 mm) thick, with at least one exterior low emittance surface (0.1 or less) and a core material containing voids or cells.

3.2.11.1 *Discussion*—Reflective plastic core insulation materials are one specific type of reflective insulation materials.

3.2.12 *self-supporting specimen, n*—a specimen that remains in place by its own structural characteristics both before and during the fire test.

4. Summary of Practice

4.1 This practice describes procedures for specimen preparation and mounting when testing pipe and duct insulation materials to assess flame spread and smoke development as surface burning characteristics using Test Method E84.

4.2 Pipe or duct insulation systems (or composites related to pipe or duct insulation) consist of an insulation core, with or without a jacket, and with or without an adhesive. Pipe or duct insulation systems shall be tested in accordance with the specimen preparation and mounting procedures described in this practice, using Test Method E84.

4.3 Supplementary materials for pipe or duct insulation systems, including tapes, joint sealants, and fitting covers, that are intermittently spaced, shall be tested for flame spread and smoke development as single-component systems, using Test Method E84.

5. Significance and Use

5.1 Pipe and duct insulation systems are often evaluated with Test Method E84 to comply with building or mechanical code requirements. This practice describes, in detail, specimen preparation and mounting procedures for single-component pipe or duct insulation systems and for multi-component pipe or duct insulation systems.

5.2 The material, system, composite, or assembly tested shall be representative of the completed insulation system used in actual field installations, in terms of the components, including their respective thicknesses.

5.3 Pipe and duct insulation systems consist of a variety of materials and constructions.

5.4 Some testing laboratories have developed a number of protocols for testing pipe or duct insulation systems which utilize one generic type of materials, all of them with an insulation core and a jacket. Those protocols are the origin of this practice, which makes them generic, to reduce material bias in the standard; they have resulted in the procedures presented in 6.1. The procedures presented in 6.2 – 6.5 address other types of pipe or duct insulation systems.

[4] This definition is similar to the definition of "blanket insulation" in Terminology C168 from committee C16 on Thermal Insulation.

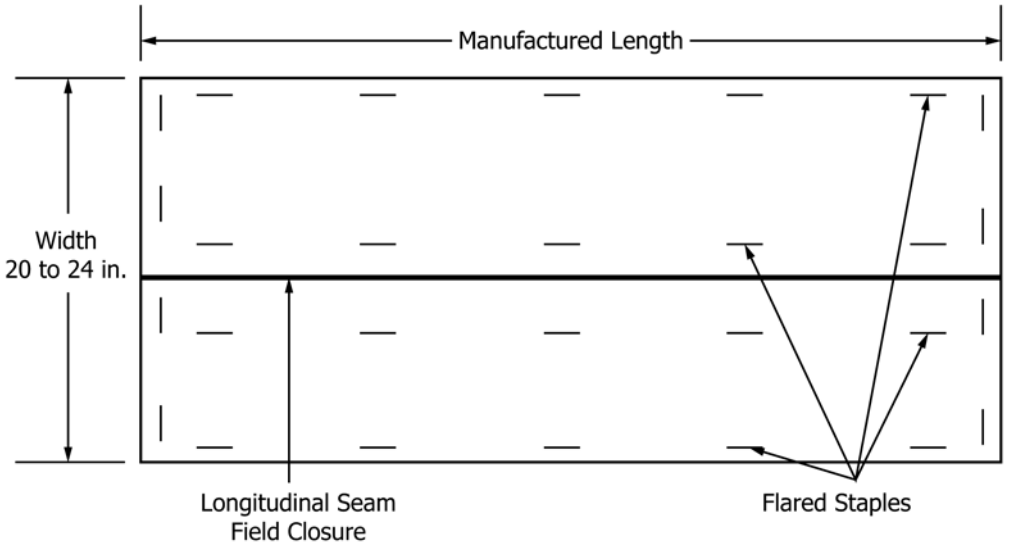

FIG. 1 Insulation and Jacket with No Adhesive (see 6.1.1.1)

5.5 This practice addresses specimen preparation and mounting of systems of the types described in 5.5.1 – 5.5.3 and testing of supplementary materials as described in 5.6.

5.5.1 Multi-component systems containing an insulation core and a jacket, with or without adhesive between insulation core and jacket, not intended to be bonded to a pipe or duct substrate. Specimen preparation and mounting for such systems is described in 6.1 if they are self-supporting and in 6.2 if they are not self-supporting.

5.5.2 Single component systems, not intended to be bonded to a pipe or duct substrate. Specimen preparation and mounting for such systems is described in 6.3 if they are self-supporting and in 6.4 if they are not self-supporting.

5.5.3 Systems intended to be bonded to a pipe or duct substrate. Specimen preparation and mounting for such systems is described in 6.5.

5.5.4 Reflective insulation materials (see 3.2.10 and 3.2.11) intended to be used as pipe or duct insulation materials and installed with an air gap shall be tested using the procedures for specimen preparation and mounting procedures described in Practice E2599. Reflective insulation materials intended to be used as pipe or duct insulation materials and installed without an air gap shall be tested using the specimen preparation and mounting procedures described in Section 6 of this practice.

5.5.5 Specimen preparation and mounting procedures for systems not described in this practice shall be added as the information becomes available.

5.6 *Supplementary Materials:*

5.6.1 It is recognized that supplementary materials for pipe or duct insulation systems are normally able to generate heat, flame or smoke. Thus, the fire safety of the entire system depends, at least to some extent, on the fire performance of supplementary materials. Consequently, the fire-test-response characteristics of all supplementary materials shall be assessed to obtain a full assessment of the fire-test-response of the pipe or duct insulation system. See Appendix X1.

5.6.2 Supplementary materials are often present intermittently spaced, and not for an extended length, in a pipe or duct insulation system. Thus, it is not always possible to suitably test them in conjunction with a pipe or duct insulation system.

5.6.3 *Testing of Supplementary Materials*—Supplementary materials that have not been fully tested in conjunction with the pipe or duct insulation system, in accordance with Section 6, shall be tested for flame spread and smoke development as single-component systems, in accordance with Test Method E84.

5.7 The limitations for this procedure are those associated with Test Method E84.

6. Specimen Preparation and Mounting

6.1 Self-supporting multi-component systems, not intended to be bonded to a pipe or duct substrate:[5]

6.1.1 Hollow cylindrical insulation core inside a jacket, with a longitudinal joint system, to be used without adhesive between jacket and insulation core:

6.1.1.1 In this construction, the insulation board specimens, 20 to 24 in. (510 to 610 mm) by the appropriate length, shall be produced in a flat cross-section with the jacket (facing) with a seam created at the approximate longitudinal centerline using the same method of closure used in actual field installations. The jacket (facing) shall be mechanically attached to the insulation core using 0.5 in. (13 mm) divergent point steel flared staples. The staples shall be applied, around the perimeter of the board, at 6 ± 3 in. (152 ± 76 mm) on center spacing, as well as adjacent to and along both sides of the longitudinal seam, at approximately 1 in. from the seam (see Fig. 1).

[5] The specimen preparation and mounting procedures in 6.1, including potentially slitting the facing or jacket, mirror those used by Underwriters Laboratories, and described in their documents "BRER GuideInfo—Pipe and Equipment Coverings—[Building Materials] (Surface Burning Characteristics)" and "BIYR GuideInfo—Acoustical Materials—[Building Materials] (Surface Burning Characteristics)." Similar concepts are also used in the testing of Factory-made Air Ducts and Air Connectors by Test Method E84 in UL 181.

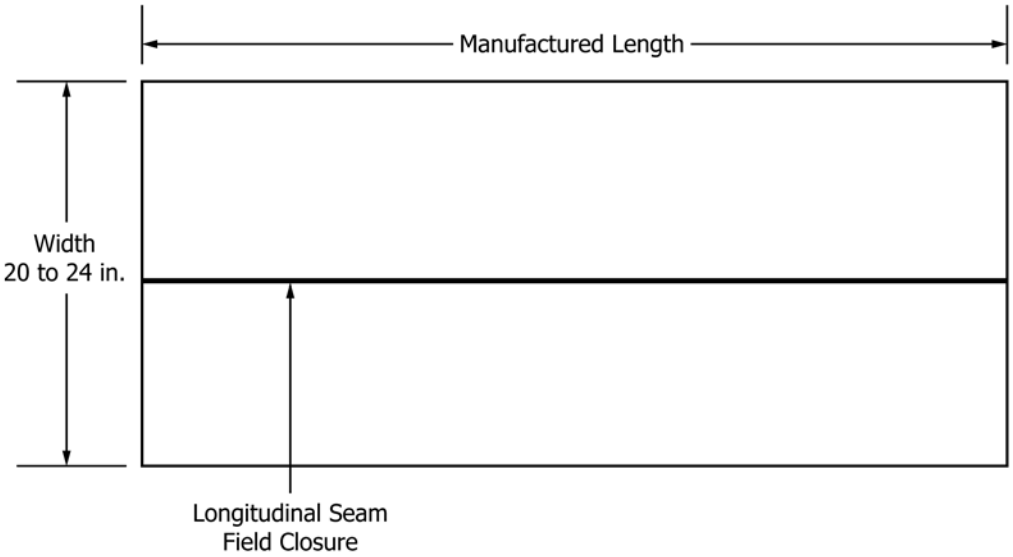

FIG. 2 Insulation and Jacket with Full Coat Adhesive (see 6.1.2.1 and 6.1.4.1)

6.1.1.2 Mount the specimens on the ledges of the Test Method E84 furnace without using an auxiliary support mechanism.

6.1.2 Hollow cylindrical insulation core inside a jacket, with a full coat adhesive attaching the jacket to the insulation core:

6.1.2.1 In this construction, the insulation board specimens, 20 to 24 in. (510 to 610 mm) by the appropriate length, shall be produced in a flat cross-section with the jacket (facing) adhered to one side of the insulation core (see Fig. 2).

6.1.2.2 Each test shall be conducted using a factory or field joint along the longitudinal centerline of the test specimen, with a longitudinal seam created in the approximate centerline using the same method of closure used in actual field installations.

6.1.2.3 It shall be permitted to represent the field joint by introducing a longitudinal slit cut along the longitudinal centerline of the specimen jacket and applying the manufacturer's recommended field closure system (if applicable).[6]

6.1.2.4 For each test, mount the specimens on the ledges of the Test Method E84 furnace without using an auxiliary support mechanism.

6.1.3 Hollow cylindrical insulation core inside a jacket, with longitudinal adhesive beads or stripes in a stitch pattern attaching the jacket to the insulation core:

6.1.3.1 In this construction, the insulation board specimens, 20 to 24 in. (510 to 610 mm) by the appropriate length, shall be produced in a flat cross-section with the jacket (facing) laminated to one side of the insulation core. The adhesive bead or stripe spacing shall be the same as used in the actual field installation. Divergent point steel flared staples, 0.5 in. (13 mm) in size, shall be applied, around the perimeter of the board, at 6 ± 3 in. (152 ± 76 mm) on center spacing, as well as adjacent to and along both sides of the longitudinal seam, at approximately 1 in. from the seam (see Fig. 3).

6.1.3.2 For each test, mount the specimens on the ledges of the Test Method E84 furnace without using an auxiliary support mechanism.

6.1.4 Insulation core board with a jacket laminated to the insulation:

6.1.4.1 In this system the resulting longitudinal seam shall be closed with either an adhesive tape or a vapor retarder lap adhesive. In this construction, the insulation board specimens, 20 to 24 in. (510 to 610 mm) by the appropriate length, shall be produced in a flat cross-section with the jacket (facing) laminated to one side of the insulation core (see Fig. 2).

6.1.4.2 Each test shall be conducted using a factory or field joint along the longitudinal centerline of the test specimen, with a longitudinal seam created in the approximate centerline using the same method of closure used in actual field installations.

6.1.4.3 It shall be permitted to represent the field joint by introducing a longitudinal slit cut along the longitudinal centerline of the specimen jacket and applying the manufacturer's recommended field closure system (if applicable).[6]

6.1.4.4 For each test, mount the specimens on the ledges of the Test Method E84 furnace without using an auxiliary support mechanism.

6.1.5 Hollow cylindrical insulation core inside a jacket laminated to the outer circumference of the insulation core, with the jacket (facing) attached to the insulation core by means of a longitudinal adhesive stripe pattern, on opposite sides of the longitudinal seam:

6.1.5.1 In this construction, the insulation board specimens, 20 to 24 in. (510 to 610 mm) by the appropriate length, shall be produced in a flat cross-section with the jacket (facing) laminated to one side of the insulation core. The adhesive bead or stripe spacing shall be the same as used in the actual field installation. Divergent point steel flared staples, 0.5 in. (13 mm) in size, shall be applied, around the perimeter of the board, at 6 ± 3 in. (152 ± 76 mm) on center spacing, as well as adjacent to and along both sides of the longitudinal seam, at approximately 1 in. from the seam (see Fig. 3).

[6] This testing is intended to investigate the contribution of all combustibles to the flame spread and smoke developed by the system to be used in the actual field installation.

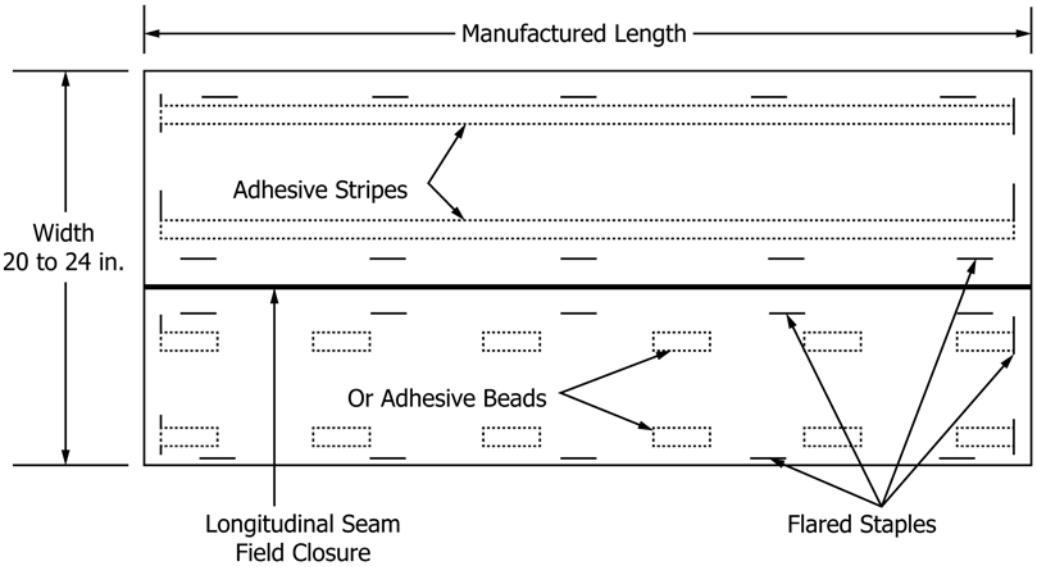

FIG. 3 Insulation and Jacket with Full Coat Adhesive (see 6.1.3.1 and 6.1.5.1)

6.1.5.2 For each test, mount the specimens on the ledges of the Test Method E84 furnace without using an auxiliary support mechanism.

6.1.6 Insulation core inside an overlapping jacket laminated to the outer circumference of the insulation core with transverse adhesive stripes. The jacket (facing) shall be attached to the insulation core by means of a transverse adhesive stripe pattern, with the resulting longitudinal seam closed with either an adhesive tape or a vapor retarder lap adhesive.

6.1.6.1 In this construction, the insulation board specimens, 20 to 24 in. (510 to 610 mm) by the appropriate length, shall be produced in a flat cross-section with the jacket (facing) laminated to one side of the insulation core using the same transverse adhesive stripe spacing as used in the actual insulation system. A longitudinal seam shall be created in the approximate center of the specimen, using the same method of closure as used in the actual insulation system. If necessary, 0.5 in. (13 mm) divergent point steel flared staples shall be applied around the perimeter of the board, at 6 ± 3 in. (152 ± 76 mm) on center longitudinal spacing (See Fig. 4).

6.1.6.2 For each test, mount the specimens on the ledges of the Test Method E84 furnace without using an auxiliary support mechanism.

6.2 Non self-supporting, multi-component systems not intended to be bonded to a pipe or duct substrate:

6.2.1 In all of these constructions, the test specimens shall be prepared as described in 6.1.1 – 6.1.6 (as appropriate).

6.2.2 If the physical characteristics of the core material (or blanket) permit, and the core material (or blanket) is at least 1 in. (25 mm) thick[7], for each test, insert steel rods, 0.25 in. (6 mm) in diameter by 20 to 24 in, (510 to 610 mm) in length, through the material, so that the bottom of the rod is approximately 0.25 in. (6 mm) from the surface to be exposed to the flame. The steel rods shall be placed at approximately 2 ft (0.6 m) intervals starting with the fire end of the panel, approximately 2 in. (51 mm) from the end of the test specimen.[8]

6.2.3 If the physical characteristics of the core material are such that they do not permit insertion of steel rods through it, and the material has a jacket, mount the test specimens on sheet metal, held in place with stick pins or speed-clips. The stick pins or speed-clips shall be placed in two longitudinal rows, centered across the width of the test specimen.

6.2.3.1 If the test specimen sections are 4 ft (1.2 m) or longer, the spacing of the stick pins or speed-clips shall be at approximately 2 ft. (0.6 m) intervals starting with the fire end of the panel.

6.2.3.2 If the test specimen sections are less than 4 ft (1.2 m) in length, the spacing of the stick pins or speed-clips shall be at approximately 18 in. (0.45 m) intervals starting with the fire end of the panel.

6.2.4 For materials without a jacket, if the physical characteristics of the core material are such that they do not permit insertion of steel rods through it, or if the core material is less than 1 in. (25 mm) thick, for each test, mount the test specimens on the ledges of the Test Method E84 furnace by supporting the specimens on steel rods, 0.25 in. (6.3 mm) in diameter by 20 to 24 in. (510 to 610 mm) in length that span the width of the tunnel furnace. The steel rods shall be placed at approximately 2 ft (0.6 m) intervals starting with the fire end of the panel, approximately 2 in. (51 mm) from the end of the test specimen.[8]

6.2.5 For materials without a jacket, if visual observation indicates that the test specimen will not be adequately supported by steel rods as indicated in 6.2.2 or 6.2.4, mount the test specimens as described in 6.2.3 through 6.2.3.2.

[7] This mounting method, described in Section X1.4 of Test Method E84, is intended for single-component batt or blanket materials that do not have sufficient rigidity or strength to support themselves and is inappropriate for materials less than 1 in. (25 mm) thick.

[8] The placement of steel rods within the tunnel is described in Section X1.1.2.2 of Test Method E84.

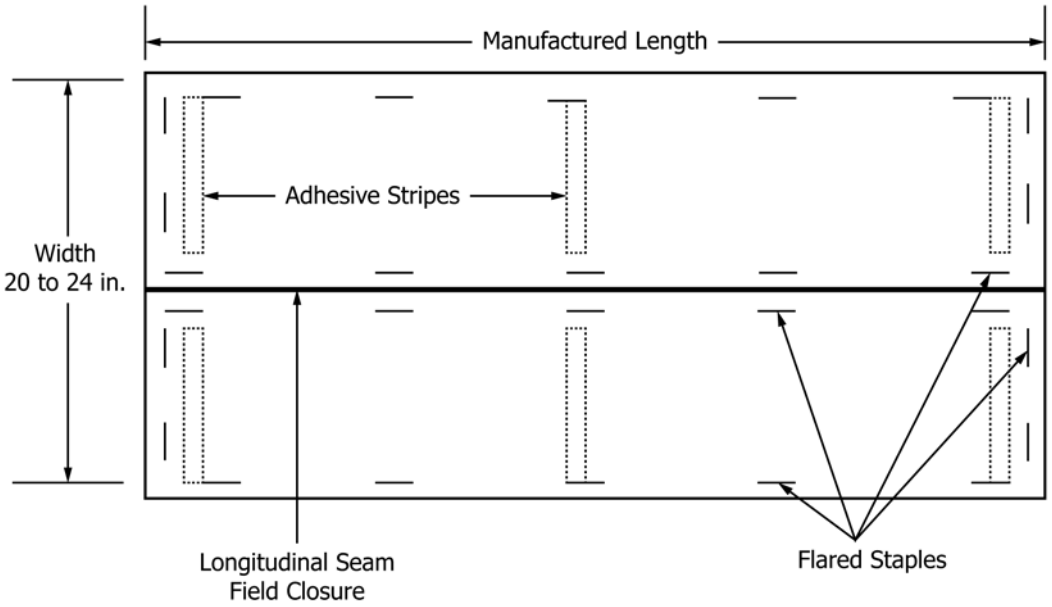

FIG. 4 Insulation and Jacket with Transverse Adhesive Stripes (see 6.1.6.1)

6.3 Self-supporting, single-component systems, not intended to be bonded to a pipe or duct substrate:

6.3.1 Insulations capable of being produced in flat sections:

6.3.1.1 In this construction, the insulation board test specimens, 20 to 24 in. (510 to 610 mm) by the appropriate length, shall be produced in a flat cross-section that duplicates the thickness used in the actual field installation in its cylindrical form.

6.3.1.2 For each test, mount the specimens on the ledges of the Test Method E84 furnace without using an auxiliary support mechanism.

6.3.2 Insulations that cannot be produced in flat sections:

6.3.2.1 This is the case of self-supporting systems that consist of series of smaller size cylindrical sections, and that cannot be produced in flat sections. In this case, flat insulation board specimens shall be produced by flattening the tubular systems (if this can be done without crushing the systems). The specimens shall be 20 to 24 in. by up to 72 in. (510 to 610 mm by up to 1830 mm) flattened cross-sections that duplicate thicknesses used in the actual field installation in its tubular form. The cylindrical sections shall be bonded to each other with the actual adhesive used in the field installation, all adhesive joints to run longitudinally.

6.3.2.2 If the systems cannot be flattened without crushing them, the specimens shall be produced by bonding system sections that are almost flat.

6.3.2.3 If the flattened system remains self-supporting, for each test, mount the specimens on the ledges of the Test Method E84 furnace without using an auxiliary support mechanism.

6.3.2.4 If the flattened system becomes non self-supporting, use the appropriate mounting method from 6.4.

6.4 Non self-supporting, single-component systems, not intended to be bonded to a pipe or duct substrate:

6.4.1 Single-component systems at least 1 in. (25 mm) thick:

6.4.1.1 In this construction, the insulation board test specimens, 20 to 24 in. (510 to 610 mm) by the appropriate length, shall be produced in a flat cross-section that duplicates the thickness used in the actual field installation in its cylindrical form.

6.4.1.2 If the physical characteristics of the material permit[7], insert steel rods, 0.25 in. (6 mm) in diameter by 20 to 24 in. (510 to 610 mm) in length, through the material, so that the bottom of the rod is approximately 0.25 in. (6 mm) from the surface to be exposed to the flame.[8]

6.4.1.3 For each test, mount the test specimens on the ledges of the Test Method E84 furnace using the steel rods as an auxiliary support mechanism.

6.4.1.4 If the physical characteristics of the material are such that they do not permit the insertion of steel rods through the material, mount the test specimens as described in 6.2.3 through 6.2.3.2.

6.4.1.5 If the physical characteristics of the material are such that they do not permit the insertion of steel rods through the material, as an alternative to mounting the test specimens as described in 6.2.3 through 6.2.3.2, testing shall be permitted to be conducted with the test specimens bonded to sheet metal as described in 6.5.

6.4.2 Single-component systems less than 1 in. (25 mm) thick:

6.4.2.1 In this construction, the insulation board test specimens, 20 to 24 in. (510 to 610 mm) by the appropriate length, shall be produced in a flat cross-section that duplicates the thickness used in the actual field installation in its cylindrical form.

6.4.2.2 For each test, mount the test specimens on the ledges of the Test Method E84 furnace by supporting the specimens on steel rods, 0.25 in. (6.3 mm) in diameter by 20 to 24 in. (510 to 610 mm) in length that span the width of the tunnel furnace. The steel rods shall not be inserted through the specimen. The steel rods shall be placed at approximately 2 ft (0.6 m) intervals

starting with the fire end of the panel, approximately 2 in. (51 mm) from the end of the test specimen.[8]

6.4.2.3 If visual observation indicates that the test specimen will not be adequately supported by steel rods through the material, mount the test specimens as described in 6.2.3 through 6.2.3.2.

6.4.2.4 If the physical characteristics of the material are such that they do not permit the insertion of steel rods through the material, as an alternative to mounting the test specimens described in 6.2.3 through 6.2.3.2, testing shall be permitted to be conducted bonded with the test specimens to sheet metal as described in 6.5.

6.5 Systems intended to be bonded to a pipe or duct substrate:

6.5.1 In all of these constructions, the test specimens shall be prepared as described in the appropriate section of 6.1 – 6.4. The test specimens shall then be bonded to sheet metal, not less than 0.016 in. (0.4 mm) thick, using the bonding adhesive or attachment specified by the manufacturer for use in the actual installation.

6.5.2 When field installation requires the longitudinal joints of the insulation material to be adhered to each other, the test specimens shall include a longitudinal seam in the approximate center of the test specimen, using the same adhesion method as used in the actual installation.

6.5.3 For each test, mount the specimens on the ledges of the Test Method E84 furnace without using an auxiliary support mechanism.

6.6 Optional alternatives to sheet metal:

6.6.1 The following materials are acceptable optional alternates to sheet metal, as required in 6.4.1.5, 6.4.2.4 and 6.5.1:

6.6.1.1 Fiber-cement board, ¼ in. (6.3 mm) thick, complying with Specification C1136 (Grade II) and the requirements contained in the Annex on Fiber-Cement Board Requirements of Test Method E84, and

6.6.1.2 Type X gypsum wallboard, ⅝ in. (15.9 mm) thick, complying with Specification C1396/C1396M.

7. Testing of Specimens

7.1 All testing shall be conducted using the methodology described in Test Method E84.

8. Operator Safety

8.1 The primary concerns for operator safety are associated with the fire-test-response procedure, Test Method E84, and not with the specimen preparation procedure. Safety recommendations are included in Test Method E84.

9. Report

9.1 Report a detailed description of the system being tested.

9.2 Report a detailed description of the specimen preparation and mounting method used, per Section 6.

9.3 Report all the information required in the reporting section of Test Method E84, including observations, graphical results and the values of the flame spread index and of the smoke developed index in each test.

APPENDIX

(Nonmandatory Information)

X1. COMMENTARY

X1.1 *Introduction*—It has been shown that the careful replication of realistic fire scenarios is the most appropriate means of fire testing of complex systems. However, this is not always achievable within the confines of a standard test method.

X1.2 The use of any standard fire test method intrinsically carries some limitations, including the source of heat or flame, the specimen size and orientation, the specimen location and the fire-test-response characteristics measured.

X1.3 Fire tests on pipe insulation systems and duct insulation systems are often conducted by using Test Method E84.

X1.3.1 The source of heat and flame in Test Method E84 are two gas burners supplying approximately 300 000 BTU/h (87.9 kW) onto the test specimen from underneath for a period of 10 min.

X1.3.2 The approximate specimen sizes in Test Method E84 are 24 ft (7.3 m) long by 20 to 24 in. (510-610 mm) wide. The recommended specimen thickness is up to 4 in. (102 mm) thick.

X1.3.3 The specimen is placed below the lid of the test chamber at a specified location.

X1.3.4 Test Method E84 assesses the comparative surface burning behavior of building materials by providing values of the flame spread index and the smoke developed index, both of which are comparative measures.

X1.4 *Testing of Realistic Systems*

X1.4.1 *Supplementary Materials:*

X1.4.1.1 Testing of a pipe or duct insulation system that contains every one of the supplementary materials used in the actual installation is not required by this practice, because of the difficulty of mounting all of the supplementary materials as part of the insulation system in Test Method E84.

X1.4.1.2 The difficulty in testing systems containing all supplementary materials may be due to the varying locations where they are found, without extending for significant lengths, or to their awkward physical shapes or dimensions.

X1.4.1.3 However, it is recognized that each one of the supplementary materials for pipe and duct insulation systems may either increase or decrease the fire safety of the insulation

system. Thus, as the fire safety of the entire system depends, at least to some extent, on the fire performance of the supplementary materials, which may either improve or worsen the fire performance of the base system, the testing of all of the supplementary materials is required by this standard practice (see 5.6, X1.4.1.4, and X1.4.1.5).

X1.4.1.4 This standard practice requires that such testing be achieved either by testing the materials individually, using the procedures in Test Method E84 or by testing complete realistic systems within Test Method E84.

X1.4.1.5 Alternatively, the effect of supplementary materials on the fire performance of the entire insulation system could be evaluated by some full-scale fire test methods, but that is outside the scope of this standard practice.

X1.4.2 *Testing of Pipes or Ducts with Insulation:*

X1.4.2.1 Testing of a specimen that includes both the insulation system as well as the pipes or ducts is not considered in this standard practice.

X1.4.2.2 Such testing would probably be inconsistent with the sample size requirements in Test Method E84.

X1.4.2.3 Such an approach could show a more complete picture of the fire performance of the system, by taking into account the effects of the pipes or ducts themselves and of the actual geometry used in installation practices.

X1.4.2.4 The effect of the pipe or duct itself on the fire performance of the entire system could be evaluated by some full-scale fire test methods, but that is outside the scope of this standard practice.

X1.5 The mounting of test specimens on the ledges of the Test Method E84 furnace by supporting the specimens on poultry netting placed on steel rods is not approved for testing pipe and duct insulation materials. The approved mounting methods are those described in 6.1 through 6.6 of Practice E2231. Thus, optional mounting methods from Appendix X1.1.1 of Test Method E84, including one that describes the use of 20-gage, 2 in. (51 mm) hexagonal galvanized steel poultry netting conforming to Sepcification A390, are not to be used for specimen preparation or mounting of pipe and duct insulation materials.